

CLAIMS

What is claimed is:

1. A speaker system providing enhanced intelligibility of a reproduced audio program signal in the presence of ambient noise comprising:
 - means for receiving the reproduced audio program signal;
 - a microphone for monitoring ambient noise signals and for providing a microphone output signal;
 - means for enabling the microphone output signal during first increments of time when the reproduced audio program signal is substantially off, and disabling the microphone output signal during second increments of time when the reproduced audio program signal is on, such that the microphone output signal includes ambient noise signal components without including reproduced program signal components; and
 - a signal process, coupled to the means for receiving and the means for enabling/disabling, including a first transfer function having a signal process output signal, the first transfer function providing incrementally increasing gain adjustments to the reproduced audio program signal as a function of an increasing amplitude of the microphone output signal, and vice versa, wherein the signal process output signal is maintained during such times as the microphone output signal is disabled.
2. The speaker system according to claim 1, wherein the incremental gain adjustments are in steps of between about 1 dB and about 10 dB.
3. The speaker system according to claim 1, further comprising a first amplifier having an input and an output, the first amplifier input coupled to the signal process output signal of the signal process and the first amplifier output coupled to a first speaker input of a first speaker.
4. The speaker system according to claim 3, wherein the first speaker comprises a single speaker driver having a diaphragm diameter not greater than about 100 centimeters (cm).
5. The speaker system according to claim 3, further comprising:

a low-pass filter having an input and an output, the filter input coupled to the signal process output signal of the signal process and the filter output augmenting the first speaker output in a low frequency region; and
a second amplifier having an input and output, the first amplifier input coupled to the filter output and the first amplifier output coupled to a second speaker input of a second speaker.

6. The speaker system according to claim 5, wherein the first and second speakers each comprise a single speaker driver having a diaphragm diameter not greater than about 100 centimeters (cm).

7. A speaker system providing enhanced intelligibility of a reproduced audio program signal in the presence of ambient noise comprising:

means for receiving the reproduced audio program signal;

a microphone for monitoring ambient noise signals and for providing a microphone output signal;

means for enabling the microphone output signal during first increments of time when the reproduced audio program signal is substantially off, and disabling the microphone output signal during second increments of time when the reproduced audio program signal is on, such that the microphone output signal includes ambient noise signal components without including reproduced program signal components; and

a signal process, coupled to the means for receiving and the means for enabling/disabling, including a second transfer function having a signal process output signal, the second transfer function providing increasing high frequency response of the reproduced audio program signal as a function of a decreasing amplitude of the microphone output signal, and vice versa, wherein the signal process output signal is maintained during such times as the microphone output signal is disabled.

8. The speaker system according to claim 7, further comprising a first amplifier having an input and an output, the first amplifier input coupled to the signal process output signal of the signal process and the first amplifier output coupled to a first speaker input of a first speaker.

9. The speaker system according to claim 8, wherein the first speaker comprises a single speaker driver having a diaphragm diameter not greater than about 100 centimeters (cm).
10. The speaker system according to claim 8, further comprising:
 - a low-pass filter having an input and an output, the filter input coupled to the signal process output signal of the signal process and the filter output augmenting the first speaker output in a low frequency region; and
 - a second amplifier having an input and output, the first amplifier input coupled to the filter output and the first amplifier output coupled to a second speaker input of a second speaker.
11. The speaker system according to claim 10, wherein the first and second speakers each comprise a single speaker driver having a diaphragm diameter not greater than about 100 centimeters (cm).
12. A speaker system providing enhanced intelligibility of a reproduced audio program signal in the presence of ambient noise comprising:
 - means for receiving the reproduced audio program signal;
 - a microphone for monitoring ambient noise signals and for providing a microphone output signal;
 - means for enabling the microphone output signal during first increments of time when the reproduced audio program signal is substantially off, and disabling the microphone output signal during second increments of time when the reproduced audio program signal is on, such that the microphone output signal includes ambient noise signal components without including reproduced program signal components; and
 - a signal process, coupled to the means for receiving and the means for enabling/disabling, including a first transfer function and a second transfer function having at least one signal process output signal, wherein:
 - the first transfer function provides incrementally increasing gain adjustments to the reproduced audio program signal as a function of an increasing amplitude of the microphone output signal, and vice versa;

the second transfer function provides increasing high frequency response of the reproduced audio program signal as a function of a decreasing amplitude of the microphone output signal, and vice versa; and

the at least one signal process output signal is maintained during such times as the microphone output signal is disabled.

13. The speaker system according to claim 12, wherein the incremental gain adjustments are in steps of between about 1 dB and about 10 dB.
14. The speaker system according to claim 12, further comprising a first amplifier having an input and an output, the first amplifier input coupled to the at least one signal process output signal of the signal process and the first amplifier output coupled to a first speaker input of a first speaker.
15. The speaker system according to claim 14, wherein the first speaker comprises a single speaker driver having a diaphragm diameter not greater than about 100 centimeters (cm).
16. The speaker system according to claim 14, further comprising:
 - a low-pass filter having an input and an output, the filter input coupled to the at least one signal process output signal of the signal process and the filter output augmenting the first speaker output in a low frequency region; and
 - a second amplifier having an input and output, the first amplifier input coupled to the filter output and the first amplifier output coupled to a second speaker input of a second speaker.
17. The speaker system according to claim 16, wherein the first and second speakers each comprise a single speaker driver having a diaphragm diameter not greater than about 100 centimeters (cm).
18. A method of enhanced intelligibility of a reproduced audio program signal in the presence of ambient noise in a speaker system comprising the steps of:
 - receiving the reproduced audio program signal;
 - monitoring ambient noise signals using a microphone to provide a microphone output signal;

enabling the microphone output signal during first increments of time when the reproduced audio program signal is substantially off, and disabling the microphone output signal during second increments of time when the reproduced audio program signal is on, such that the microphone output signal includes ambient noise signal components without including reproduced program signal components; and processing the reproduced audio program signal and the microphone output signal using a first transfer signal, the first transfer function having a signal process output signal, the first transfer function providing incrementally increasing gain adjustments to the reproduced audio program signal as a function of an increasing amplitude of the microphone output signal, and vice versa, wherein the signal process output signal is maintained during such times as the microphone output signal is disabled.

19. The method according to claim 18, wherein the incremental gain adjustments are in steps of between about 1 dB and about 10 dB.
20. The method according to claim 18, further comprising the steps of:
amplifying the signal process output signal using a first amplifier to produce a first amplified output signal; and
coupling the first amplified output signal to a first speaker input of a first speaker.
21. The method according to claim 20, further comprising the steps of:
filtering the signal process output signal using a low-pass filter to produce a filtered output signal;
amplifying the filtered output signal using a second amplifier to produce a second amplified output signal; and
coupling the first amplified output signal to a second speaker input of a second speaker.
22. A method of enhanced intelligibility of a reproduced audio program signal in the presence of ambient noise in a speaker system comprising the steps of:
receiving the reproduced audio program signal;
monitoring ambient noise signals using a microphone to provide a microphone output signal;

enabling the microphone output signal during first increments of time when the reproduced audio program signal is substantially off, and disabling the microphone output signal during second increments of time when the reproduced audio program signal is on, such that the microphone output signal includes ambient noise signal components without including reproduced program signal components; and processing the reproduced audio program signal and the microphone output signal using a second transfer signal, the second transfer function providing increasing high frequency response of the reproduced audio program signal as a function of a decreasing amplitude of the microphone output signal, and vice versa, wherein the signal process output signal is maintained during such times as the microphone output signal is disabled.

23. The method according to claim 22, further comprising the steps of:
amplifying the signal process output signal using a first amplifier to produce a first amplified output signal; and
coupling the first amplified output signal to a first speaker input of a first speaker.
24. The method according to claim 23, further comprising the steps of:
filtering the signal process output signal using a low-pass filter to produce a filtered output signal;
amplifying the filtered output signal using a second amplifier to produce a second amplified output signal; and
coupling the first amplified output signal to a second speaker input of a second speaker.
25. A method of enhanced intelligibility of a reproduced audio program signal in the presence of ambient noise in a speaker system comprising the steps of:
receiving the reproduced audio program signal;
monitoring ambient noise signals using a microphone to provide a microphone output signal;
enabling the microphone output signal during first increments of time when the reproduced audio program signal is substantially off, and disabling the microphone output signal during second increments of time when the reproduced audio program

signal is on, such that the microphone output signal includes ambient noise signal components without including reproduced program signal components; and processing the reproduced audio program signal and the microphone output signal using a first transfer signal and a second output signal, the first and second transfer functions having at least one signal process output signal, wherein:

the first transfer function provides incrementally increasing gain adjustments to the reproduced audio program signal as a function of an increasing amplitude of the microphone output signal, and vice versa;

the second transfer function provides increasing high frequency response of the reproduced audio program signal as a function of a decreasing amplitude of the microphone output signal, and vice versa; and

the at least one signal process output signal is maintained during such times as the microphone output signal is disabled.

26. The method according to claim 25, wherein the incremental gain adjustments are in steps of between about 1 dB and about 10 dB.
27. The method according to claim 25, further comprising the steps of:
amplifying the at least one signal process output signal using a first amplifier to produce a first amplified output signal; and
coupling the first amplified output signal to a first speaker input of a first speaker.
28. The method according to claim 27, further comprising the steps of:
filtering the at least one signal process output signal using a low-pass filter to produce a filtered output signal;
amplifying the filtered output signal using a second amplifier to produce a second amplified output signal; and
coupling the first amplified output signal to a second speaker input of a second speaker.